Final Report: Impact of Flurprimidol and Imidicloprid

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The first objective in this study was to examine the effects of the plant growth regulator (PGR) flurprimidol on Patmore green ash to assess its impact on resistance to ash leaf curl aphid (*Prociphilus fraxinifolli*), European fruit lecanium (*Parthenolecanium corni,* Bouché, 1844) – a soft scale, and oystershell scale (*Lepidospahes ulni*, L., 1758) – an armored scale. Plant defense theory predicts that decreasing plant growth without impacting photosynthesis can increase the amount of carbon available for utilization in other plant processes, in particularly plant defense and stress resistance. We hypothesized that trees treated with flurprimidol, a gibberellin inhibiting plant growth regulator, would exhibit reduced growth but increased accumulation of carbon that could be utilized for plant defense against the aphids and scales. Thus, we predicted greater amounts of foliar carbon and phenolics and a decreased presence of the insects in those treatments. Since previous studies have suggested a link between herbivore defense and drought stress resistance in trees, we hypothesized that trees treated with flurprimidol would show evidence for a significant increase in water use efficiency (WUE) in the trees as well. Water use efficiency is roughly calculated as the amount of carbon gained in photosynthesis per unit of water lost through transpiration. Trees with high WUE thus are better able to acquire carbon while losing less water and are therefore more resistant to drought conditions. Our third objective was to examine if flurprimidol would show any evidence for synergism by increasing the effectiveness of imidacloprid for control of

sucking insects that feed in the phloem (aphids & soft scales) and intercellular contents (hard scales).

Forty-four 'Patmore' ash trees (*F. pennsylvanica var. subintegerrima* cv Patmore) trees located in the parking were selected for this study. All of the trees have exhibited recurring infestations of the three aforementioned species of insect pests. For the duration of the study, the trees were watered throughout the growing season (mid-May through mid-October) between the hours of 6:00 a.m. – 8:00 a.m. each day of the week. Two bubblers at the base of each tree ran for duration of 10 minutes within this time period each morning, supplying approximately 30 gal of water (at a rate of 1.5 gal per minute for each bubbler). The trees were planted in a randomized complete block design with 11 blocks, with 4 trees per block. Four treatments were applied randomly to each block. The treatments consisted of (1) a no treatment control, (2) flurprimidol, (3) imidacloprid, and (4) a combination of flurprimidol and imidacloprid. Flurprimidol treatments were applied to the trees using the Wedgle Direct-Inject Tree Treatment System ™ (ArborSystems, Inc., Omaha, NE) on March 18, 2005, before bud-break in the trees. Wedgle checks were used to administer 1-ml injections for both Pointer™ imidacloprid (5% a.i.) and Mastiff™ flurprimidol (48% a.i.). One injection was applied for every 4-in of trunk circumference to maximize the distribution of the chemicals and minimize injury to the tree.

As predicted, the flurprimidol treatments did not decrease photosynthesis but did increase foliar carbon content and decreased caliper growth by over 3x as compared to the growth of the control trees. However, these changes in plant physiology did not appear to have an effect on the presence of any of the pest species examined in the study.

Nevertheless, it should be mentioned that scale species counts were only done on overwintered scale populations from 2005 that were counted in the spring of 2006. Aphid counts were performed only for spring 2006, since by the inception of the study in 2005, the aphids had finished their life cycle.

Previous studies with the Wedgle Direct Inject System and with soil drenching of imidicloprid have had significant long-term control of aphids. Thus our results are quite surprising as there were no treatment effects for imidicloprid in any of the treatments in our study. One of the proposed advantages of direct inject technology is that it places the compound in the xylem stream of the tree and thus is available more quickly throughout the tree as compared to drenches which require a year for uptake to occur through the root system of the tree. While our results are not conclusive, as there may have been errors in application and we did not follow it through 2007, we remain unconvinced that injection is the better option for imidicloprid application at this point.

Interestingly, although treatment effects observed in 2005 and 2006 were statistically insignificant at the α=0.05 level, total phenolics in 2006 were proportionally greater in trees treated with flurprimidol than in the other two treatments and control α=0.10. This data suggests that flurprimidol may influence phenolic concentrations in foliage, but further investigation into rates and efficacy need to be determined.

Water use efficiency was not impacted by the treatments in our study. Insitu assessments detailed how the trees had adapted to their environment. The watering regime employed by the University was enough to support growth of the trees, but not enough to create a surplus or stress the trees to the point that WUE would be influenced by a reduction in growth. It is apparent that at the current listed rate, while growth is

reduced, and photosynthesis is not, the impact on secondary metabolism is too slight to influence stress resistance mechanisms.

Results of this study will be published as a Master of Science Thesis in Plant Science at the University of Idaho for Mr. Poojan Tripathi. A copy of the completed thesis will be presented to the Idaho Department of Agriculture. The authors would like to extend their thanks to the University of Idaho Facilities for providing the trees for the study, to ArborSystems Inc., for providing the Wedgle Direct Inject System, and the compounds used in the study and to the IDA Nursery Advisory Committee for providing funding for completion of the project.